National Aeronautics and Space Administration

Materials and Coatings

Asymmetric Dielectric Elastomer Composite Material

Material that responds mechanically to applied voltage

This technology is an electronic active material that converts a voltage input to a mechanical force and mechanical displacement output. As compared to prior dielectric elastomer (DE) systems, the material has reduced electrode spacing, which lowers significantly the required operating voltage. In addition, the inclusion of a combination of conducting and/or non-conducting reinforcing fibers greatly enhances the strength of the material, without weight penalty.

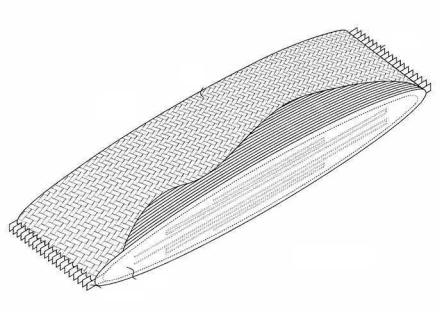
BENEFITS

- Produces actuators with higher force output than previously available
- Produces actuators that contract upon actuation rather than expand, like conventional materials
- Achieves lower operating voltages with more precise electrode spacing
- Can be optimized to provide preferential actuation characteristics, like direction
- Actuators can be coated to provide protection in hazardous environments
- Sensor and actuator functions can be combined in the same electrode-elastomer system

technology solution

THE TECHNOLOGY

This technology is a means of fabricating dielectric elastomer (DE) composite materials, i.e., materials that respond mechanically to applied voltage with displacement or force, with improved characteristics compared to currently available materials. By coating electrodes with uncured elastomer in liquid form, and thereafter assembling the electrode components, the electrodes can be woven into a fabric or fabricated in sheets. The result is a DE material that contracts upon activation, much like muscle tissue, rather than expand like conventional DE materials. Actuator forces are also greater than was possible previously. Moreover, the more precise control over electrode spacing leads to lower operating voltages.



Perspective view of an assembly of elastomer-coated conductors

APPLICATIONS

The technology has several potential applications:

- Artificial muscle and hearts
- Physical therapy/rehab devices
- Morphing aircraft
- Robotics
- Biomimetic devices
- Active structures
- Displacement and force sensors

PUBLICATIONS

Patent No: 8,704,423

More Information

National Aeronautics and Space Administration

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